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Cephaliophora tropica: a third European record

Małgorzata Ruszkiewicz-Michalska[1*], Piotr Knysak[1],
Izabela Skrobek[2], Aneta Gwiazda[2], Sebastian Piskorski[2] &
Joanna Żelazna-Wieczorek[1]

[1] *Department of Algology and Mycology & [2] Myco-Algological Section of the Students Society,*
Faculty of Biology and Environmental Protection, University of Łódź,
Banacha 12/16, PL-90-237 Łódź, Poland

[*] Correspondence to: *mrusz@biol.uni.lodz.pl*

Abstract—We describe the morphology of *Cephaliophora tropica* based on a specimen retrieved from samples of urban water bodies in Łódź city, central Poland, and isolated by a shed snakeskin bait method. We also review the species' distribution to demonstrate its circumglobal range. With previous records from Hungary and Finland, this is only the third report of *C. tropica* from Europe.

Key words—aquatic environment, conidial fungi, distribution, hyphomycetes, *Pezizales*

Introduction

Cephaliophora Thaxt. (*Pezizales, Ascomycota*) encompasses hyphomycete species without known teleomorphs (Kirk et al. 2008). Thaxter (1903) originally erected the genus for two coprophilous species: *C. tropica* (type species) and *C. irregularis* Thaxt. [= *C. nigricans* (Bainier) Bainier]. A third species accepted in the genus is *C. uniformis* Narayanan, isolated from jute sacks (Narayanan 1962). Three rotifer- and tardigrade-capturing species were also described in *Cephaliophora* as *C. longispora* G.L. Barron et al., *C. muscicola* G.L. Barron et al., and *C. navicularis* Tzean & G.L. Barron (Tzean & Barron 1983, Barron et al, 1990), but it has been suggested that they belong in *Lecophagus* (Dick 1990, Tanabe et al. 1999).

Seifert et al. (2011) refer to *C. tropica* as a pantropical and occasionally temperate species. Our survey of literature citations of *C. tropica* indicates

Table 1. Literature review of *Cephaliophora tropica* reports

Country	Host/substrate *	Reference
Africa		
Central African Republic	Dung (*Bovidae*)	CBS 139.59
Egypt	Air-borne dust	Abdel-Hafez et al. (1990) Khallil & Abdel-Sater (1992)
	Moth pupae (*Noctuidae*)	Ismail & Abdel-Sater (1993)
Ghana	*Theobroma* (*Malvaceae*)	Farr & Rossman (2016)
Liberia	Dung (*Equidae*)	Thaxter (1903)
Asia		
China	Dung (*Muridae*)	Thaxter (1903)
	Endophytic (*Salicaceae*)	Zhao & Li (2012)
India	Dung (*Cercopithecidae*)	Iyer et al. (1973)
	Soil	Barron (1968)
Indonesia	Dung (*Muridae*)	Thaxter (1903)
Iran	Soil	Pordel et al. (2015)
Israel	*Trigonella* (*Fabaceae*)	Chabelska-Frydman (1959)
Japan	Vermicompost	Huang et al. 2013
Kuwait	Soil	Moustafa (1986) Al-Musallam (1987, 1990)
Pakistan	*Helianthus* (*Asteraceae*)	Shahzad & Ghaffar (1995) Sharfun-Nahar & Hashmi (2005) Mukhtar (2010) Mushtaq & Hashmi (2005)
	Ricinus (*Euphorbiaceae*)	Dawar et al. (2014)
	Diverse substrates	Ellis (1971)
Russia	Rhizosphere (*Sapindaceae*)	Zlotnikov et al. (2007)
Thailand	Dung (rodents)	Suwanarit (1986)
Turkey	*Capsicum* (*Solanaceae*)	CBS 996.69
Australia & Oceania		
Australia	Diverse substrates	Ellis (1971)
	Painted steel panels; organic materials	Crook & Hindson (1995)
Solomon Is.	Diverse substrates	Ellis (1971)
Europe		
Finland	Wooden parts (sauna)	Salonen & Ruokola (1969)
Hungary	Dung (*Cervidae*)	Tóth (1994) Révay (1998)
North & Central America		
Barbados	Soil	Barron (1968)
Jamaica	Dung (*Herpestidae*)	Thaxter (1903) Minter et al. (2001)
Mexico	*Vachellia* (*Fabaceae*)	Ale-Agha et al. (2007)
U.S.A.	*Roystonea* (*Arecaceae*) *Spathiphyllum* (*Araceae*)	Farr & Rossman (2016)
	Helianthus (*Asteraceae*)	Roberts et al. (1986)
	Nicotiana (*Solanaceae*)	Wolf (1949)
South America		
Venezuela	Dung (animals; incl. parrots)	Delgado Avila et al. (2002)

* Plant classification acc. to Stevens (2012)

its circumglobal distribution (Table 1), showing the most numerous data originating from Asia with no reports from Arctic and Antarctic. The only European records are from Finland (Salonen & Ruokola 1969) and Hungary (Révay 1998, and literature cited therein).

Materials & methods

In 2015, a study of fungal parasites of planktonic algae was conducted in urban, eutrophic aquatic reservoirs, including the artificial flow pond Młynek on the Olechówka river in Łódź, Central Poland (51°43′32″N 19°31′28″E). The river, which flows mainly within the city limits, also supplies several other artificial flow ponds. The Młynek pond (370 × 30–95 m) is part of an urban park system and in close proximity to a large residential area. The pond is used mainly for recreation, but no swimming is allowed.

On 21 July 2015 a water sample was collected from the shoreline of the pond and held in 125 ml plastic containers. Physical parameters measured included conductivity (EC = 483.1 μS/cm), pH (= 8.2), air temperature (= 25.8°C), and water temperature (= 25.7°C).

The sample was transported in an insulated container to the laboratory of the Department of Algology and Mycology, University of Łódź. A bait method was used in order to isolate fungi in the lab (Batko 1975). Three baits (sesame seeds, shed snakeskin, onion peels) were sterilized with hypochlorite solution and UV irradiation in a laminar-flow cabinet; they were distributed onto sterile Petri dishes together with 20 ml of water sample and incubated for 30 days at 24 ± 2°C. Fungi were identified according to Ellis (1971) with the aid of a Nikon SMZ 745T stereomicroscope and Nikon E-400 light microscope (semi-solid preparations) and photographed using a Nikon DS-F1 camera.

Taxonomy

Cephaliophora tropica Thaxt., Bot. Gaz. 35: 158 (1903) Plate 1

Colonies appearing light pink to reddish brown from the colour of conidial mass, effuse. Hyphae superficial, colourless, thin-walled, septate, 5.0–7.5 μm diam. Conidiophores macronematous, with terminal or rarely lateral ampulla, clavate, straight or slightly flexuous, colourless, smooth, 2–3-celled, 24–30 × 18–20 μm; basal cell trapezoidal, in 3-celled conidiophores the middle cell often slightly sloping. Conidiogenous cells terminal, subsphaerical to clavate, 19–29 × 16–20 μm, bearing up to 3 mature and tens of smaller immature conidia visible as balloon-like outgrowths at the surface of the conidiogenous cell. Conidia forming simultaneously, solitary, mostly 2–3-septate, 18–24 × 24–37 μm; cylindrical or slightly clavate, basal cell pointed, arising from a prominent wide (≤2.5 μm diam.) hilum; pale to cinnamon brown, basal and topical cells paler than the central ones, in some mature spores basal cell almost colourless; septa darker, brown, ≤2 μm thick.

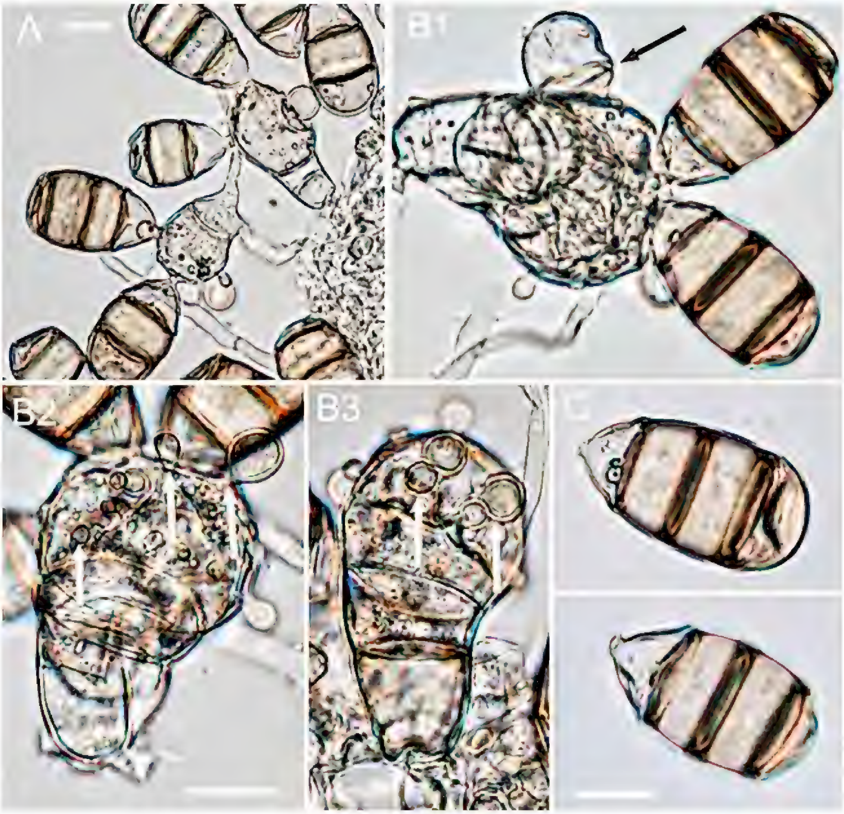

Plate 1. *Cephaliophora tropica* (LOD AF-33). A: Mature and immature conidiophores and conidia. B1–3: Conidiophores and conidiogenous cells; black arrow (B1) pointing to young two-celled conidium; white arrow (B2, B3) pointing to the youngest conidia visible as balloon-like outgrowths on the conidiogenous cell. C: mature conidia. Scale bars = 10 µm.

Specimen examined—POLAND: Łódź city, Młynek artificial flow pond, shore area, 21 July 2015, leg. P. Knysak (LOD AF-33).

Discussion

The size of the conidiophores and conidia reported by us match the lower limits of measurements given in other reports of the species. In conidia formed in the water-derived culture, the maximum number of septa was four. Similarly, Thaxter (1903) and Wolf (1949) reported 2–5-septate (mainly 3-septate) conidia, although subsequent cultural studies by Mayoral et al. (1964) and Weik & Pappelis (1964) noted conidia with up to 8 and 9 septa.

Although both of the latter studies reported conidia that were deformed or with atypical shapes, we have observed only regular conidial forms.

Beside the two main substrates of *C. tropica* (e.g., dung and soil), the diversity of reported substrata covers a range of living and dead plant and animal tissues (Table 1) as well as air-borne dust and a painted steel surface. To our knowledge, we are the first to isolate the species from a sample derived from an aquatic ecosystem. Although Kaushal & Singh (2012) reported *C. tropica* from areas surrounding water bodies in India, their photograph of the fungus does not contain necessary information to confirm the identification as *C. tropica.*

The ability to utilize diverse carbon and nitrogen sources was studied by Mayoral et al. (1964) and Weik & Pappelis (1964). *Cephaliophora tropica* grew well using all nine tested nitrogen-containing compounds, but fungal sporulation was enhanced by nitrate-N (Weik & Pappelis 1964). Cellobiose and hexoses (fructose, glucose, galactose, and mannose) proved to be the best carbon sources as indicated by mycelium dry weight and change of pH of cultural media (Mayoral et al. 1964). In our experiment, colonies of *C. tropica* developed only on shed snakeskin, suggesting that that substrate had a positive influence on growth. However, species preference toward keratin is still to be tested.

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